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WHAT IS CLAIMED IS:

1. A method of operating a liquid feed fuel cell,
comprising adding a quantity of perfluorooctanesulfonic acid to
a fuel of the fuel cell.

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#46
10 2. The method of claim 1, wherein said
perfluorooctanesulfonic acid is provided with a concentration of
at least 0.0001 M.

10 3. The method of claim 2, wherein said
perfluorooctanesulfonic acid is in the range of 0.0001 M to 0.01
Molar.

15 4. An aqueous organic fuel-feed fuel cell, comprising:
a first electrode having a first polarity;
a second electrode having a second polarity different
than the first polarity;
an electrolyte, comprising a proton-conducting
membrane which is coupled to both said first and second
20 electrodes; and

DP 1872
#6
a circulating system, operating to circulate a first
liquid organic fuel which is substantially free of acid-
containing electrolytes into an area of said first electrode to
cause a potential difference between said first and second

electrodes when a second component is in an area of said second electrode;

wherein said first electrode is formed of a porous material configured in a way to be wet by the organic fuel.

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5. A fuel cell as in claim 4, wherein said first electrode includes an additive which increases wetting properties by decreasing interfacial tension of an interface between the liquid organic fuel and a catalyst on the first electrode.

6. A method of operating a fuel cell, comprising:

preparing a first electrode to operate as a first polarity electrode, said first electrode having a first surface exposed to the fuel;

15 circulating an organic fuel which is substantially free of
any acid electrolyte into contact with said first surface of
said first electrode, said organic fuel having a component which
is capable of electro-oxidation;

preparing a second electrode which operates as a second
20 polarity electrode, said second polarity being different than
the first polarity, said second electrode having a second
surface;

preparing an electrolyte which includes a proton conducting membrane:

circulating a second reactive component into contact with said second surface of said second electrode, said second reactive component including a component capable of electro-reduction; and

5 coupling an electrical load between said first electrode and said second electrode, to receive a flow of electrons caused by a potential difference between said first and second electrodes.

10 1872 7. A method as in claim 6, wherein said organic fuel

10 includes a methanol derivative and water and is substantially free of any acid component.

1872 8. A fuel cell as in claim 4, wherein said first electrode

15 has a surface which is formed with high surface-area particles,
~~scope~~
said particles formed of alloys including at least two different kinds of metals.

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9. A fuel cell as in claim 8, wherein one of said metals

20 of said alloy is platinum.

10. A fuel cell as in claim 9, wherein said alloy is formed of platinum-ruthenium, with a composition varying from 5 to 90 atom % of platinum.

11. A fuel cell as in claim 10, wherein said alloy particles are unsupported.

5 12. A fuel cell as in claim 8 further comprising a high-
surface area carbon material for supporting said alloy particles.

10 13. An organic fuel cell, comprising:

a first chamber;
an anode electrode, formed in said first chamber, and including a first surface exposed to said first chamber, at least said first surface including an electrocatalyst and a wetting agent thereon;

15 an electrolyte, operatively associated with said anode electrode in a way to allow proton-containing materials to pass from said anode into said electrolyte, said electrolyte comprising a proton conducting membrane; and
a cathode electrode, operatively associated with said electrolyte, and having a second operative surface.

20 14. A fuel cell as in claim 13, wherein said second operative surface of said cathode electrode includes particles of electrocatalyst material thereon.

15. A fuel cell as in claim 14, wherein said electrocatalyst materials are materials optimized for electro-oxidation of a desired organic fuel.

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16. A fuel cell as in claim 15, wherein said fuel is an aqueous methanol derivative which is free of acid component and said electrocatalyst is platinum-ruthenium.

17. A fuel cell as in claim 14, wherein said particles of electrocatalyst on said cathode are optimized for gas diffusion.

18. A fuel cell as in claim 17, wherein said particles include an electrocatalyst alloy mixed with a teflon additive.

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19. A fuel cell as in claim 17, wherein said particles include an electrocatalyst mixed with said wetting agent which is an additive to promote hydrophobicity. ^{112 47"}

20. A fuel cell as in claim 14, further comprising a pumping element operating to circulate said organic fuel past said anode electrode.

21. A fuel cell apparatus, comprising:

a first chamber having surfaces for containing an organic aqueous fuel therein;

an anode structure, having a first surface in contact with said first chamber, said anode structure being porous and
5 capable of wetting the liquid fuel and also having electronic and ionic conductivity;

an electrolyte, in contact with said anode structure, said electrolyte formed of a proton-conducting membrane;

10 a cathode, in contact with said electrolyte in a way to receive protons which are produced by said anode structure, conducted through said electrolyte to said cathode; and

a second chamber, holding said cathode, said second chamber including a second material including a reducible component therein.

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22. A fuel cell as in claim 21, wherein said anode is formed of carbon paper with an electrocatalyst thereon.

23. A fuel cell as in claim 21, wherein said anode
20 includes a hydrophilic proton conducting additive.

24. A fuel cell as in claim 22, wherein said electrocatalyst layer and said carbon support are impregnated with a hydrophilic proton conducting polymer additive.

25. A fuel cell as in claim 23, wherein said polymer additive is formed of substantially the same material as the material of the electrolyte.

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26. A fuel cell as in claim 21, wherein said anode is impregnated with an ionomeric additive.

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27. A method of forming an anode with an ionomeric additive, comprising:

preparing an electrode structure having a high surface area;

impregnating the high surface area electrode structure with an electrocatalyst and binding said electrocatalyst thereto;

15 immersing the electrocatalyst-impregnated particles on said electrode structure into a solution containing an ionomeric additive;

removing said electrode structure from said solution, and drying said electrode structure; and

20 repeating said impregnating, removing and drying step until a desired composition electrode structure is obtained.

28. A method as in claim 27, wherein said electrocatalyst is bound in a polytetrafluoroethylene binder.

29. A method as in claim 27, wherein said ionomeric additive is a Nafion™-type material.

5 30. A method as in claim 27, wherein said impregnating comprises mixing electrocatalyst particles with a binder and applying said binder/electrocatalyst onto a backing to form a thin layer of greater than substantially 200 meters squared per gram.

10 31. A fuel cell comprising:

a first chamber;

an anode electrode, formed in said first chamber, and including a surface exposed to said first chamber, at least said 15 surface including an electrocatalyst material thereon, and including a hydrophobicity additive thereon;

an electrolyte operatively associated with said anode in a way to allow proton-containing materials to pass from said anode into said electrolyte, said electrolyte comprising a proton- 20 conducting membrane; and

a cathode electrode, operatively associated with said electrolyte, to receive said protons from said membrane.

32. An aqueous fuel cell, comprising:
a first electrode operating as an anode, said first
electrode being effective to catalyze an oxidation reaction of a
non-acidic component;
5 a second electrode, operating as a cathode to undergo a
reduction reaction of a non-acidic component;
a circulating system, operating to circulate a first
organic fuel in an area of said anode; and
an electrolyte, comprising a proton conducting membrane
ionically coupled with both said first and second electrodes, to
pass ions therebetween.

33. A fuel cell as in claim 32, wherein said first
electrode includes a hydrophilic proton conducting additive.

15 34. A method as in claim 6, wherein said preparing
includes adding a hydrophilic proton conducting additive to said
anode.

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20 35. An organic fuel cell, comprising:
a first chamber;
an anode electrode, formed in said first chamber, to have a
surface exposed to said first chamber, at least said surface

including particles of a material thereon which catalyzes said anode to react with non-acid containing organic fuels;

an electrolyte operatively associated with said anode in a way to allow proton-containing materials to pass from said anode
5 into said electrolyte, said electrolyte comprising a hydrogen ion conducting membrane; and

a cathode electrode, operatively associated with said membrane, to receive said ions from said membrane and to react with a specified material.

10 36. A fuel cell as in claim 36, wherein said anode includes a hydrophilic proton conducting additive.

37. A method as in claim 7, wherein said methanol derivative is dimethoxymethane mixed with water to a concentration of about .1 to 2 M.
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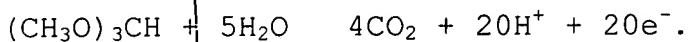
20 38. A method as in claim 7, wherein said methanol derivative includes dimethoxymethane, forming an electrochemical reaction of



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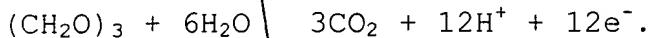
39. A method as in claim 7, wherein said methanol derivative is trimethoxymethane mixed with water to a concentration of about .1 to 2 M.

5 40. A method as in claim 7, wherein said methanol derivative includes trimethoxymethane, forming an electro chemical reaction of



10 41. A method as in claim 7, wherein said methanol derivative is trioxane mixed with water to a concentration of about .1 to 2 M.

15 42. A method as in claim 7, wherein said methanol derivative includes trioxane, forming an electro chemical reaction of



20 43. A method as in claim 7, wherein said methanol derivative is dimethoxymethane mixed with water to a concentration of about .1 to 2 M.

44. A method as in claim 7, wherein said methanol derivative includes dimethoxymethane, forming an electro chemical reaction of



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45. A method as in claim 7, wherein said methanol derivative is trimethoxymethane mixed with water to a concentration of about .1 to 2 M.

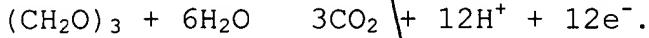
10 46. A method as in claim 7, wherein said methanol derivative includes trimethoxymethane, forming an electro chemical reaction of



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47. A method as in claim 7, wherein said methanol derivative is trioxane mixed with water to a concentration of about .1 to 2 M.

20 48. A method as in claim 7, wherein said methanol derivative includes trioxane, forming an electro chemical reaction of



49. A fuel cell as in claim 65 wherein said additive is liquid Nafion™.

50. A method of oxidizing aqueous methanol in a fuel cell reaction, comprising:

receiving aqueous methanol at an anode;

oxidizing said aqueous methanol at the anode;

producing protons from the aqueous methanol oxidizing at the anode;

allowing the protons to cross a proton conducting membrane to a cathode and reducing a second component, at the cathode, using said protons which are produced at said anode.

51. A method as in claim 131, wherein said agent is Nafion™.